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ABSTRACT

This research evaluated the total-time hypothesis for the learning of connected discourse--that in verbal learning "a fixed amount of time is necessary to learn a fixed amount of material regardless of the number of individual trials into which that time is divided." Learning material consisted of two sets of connected discourse for each of the seven lengths examined--10, 15, 20, 25, 30, 35, and 40 words-in-length. For all 14 passages, each word was typed on a radio-mat slide in preparation for projector presentation with an exposure interval for each word of .5 seconds. The subjects, introductory psychology students assigned to individual treatment on a random basis (except for sex, numerical, and inter-item balance), were presented with the learning material after a brief explanation. Basic learning data were scored in four ways: the number of trials to criterion, the number of words recalled (not necessarily correctly) on each trial, the number of three-word sequences identical with the original recalled on each trial, and the number of intrusions in each recall of each subject. Results of the research rejected the total-time hypothesis. (Lengthy appendices contain the learning material and data on the number of trials to criterion, followed by the quantitative and organizational factors, and the results for intrusions.) (JMC)

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The Influence of Inter-item Interval on the Learning of Connected Discourse

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The Influence of Inter-Item Interval on the Learning of Connected Discourse

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The basic purpose of this experiment was to evaluate the total-time hypothesis where the learning material consisted of connected discourse. Briefly stated, the total-time hypothesis holds that in verbal learning "a fixed amount of time is necessary to learn a fixed amount of material regardless of the number of individual trials into which that time is divided" (Cooper & Pantle, 1967, p. 221). For example, in serial learning, if it takes four trials to learn a 10-item list with each trial taking 20 seconds, the same list should be learned in two trials if the time for each trial is increased to 40 seconds. In both cases the total learning time is 80 seconds and the total-time hypothesis holds. A further purpose of this experiment was to evaluate the course of serial learning under various inter-item intervals in terms of component processes involved in the learning of connected discourse.

The literature on the total-time hypothesis was recently reviewed by Cooper and Pantle (1967). In this review, Cooper and Pantle focused on the total-time hypothesis in the separate areas of paired-associate, free recall, and serial learning. Generally speaking, their conclusions were the same for paired-associate and free-recall procedures. That is, the overwhelming number of studies supported the total-time hypothesis with the negative studies occuring under rather extreme procedural variations. The authors found less impressive evidence for the total-time hypothesis in reviewing the studies in serial learning. Six serial learning studies were reviewed. Of these, four supported the total-time hypothesis, one obtained negative results, and one supported the hypothesis with learning material of high meaningfulness

but failed to support the hypothesis with low meaningful material. While the evidence was perhaps not as strong as in the case of paired associate and free recall learning, most of the studies supported the total-time hypothesis in serial learning.

As the present research involves serial learning procedures, the literature that has appeared in this area after the Cooper and Pantle review will also be briefly examined. After eliminating the studies in short-term memory and incidental learning, five studies on serial recall involving a design with a reasonably direct relationship to the total-time hypothesis were found. Of these five studies, three (Harris & Lown, 1968; Jahnke, 1968; Martin, 1968) failed to support the total-time hypothesis, one (Fisher, 1966) supported the hypothesis, and one (Brewer, 1967) provided partial support.

In the Harris & Lown (1968) study, 20 digits were the learning material presented during a 40 second period. "The 20 digits were either distributed evenly over time, in two groups of 10 digits with a 20 second rest between groups, or in three groups of 6, 7, and 7 digits with 10 seconds rest between groups" (Harris & Lown, 1968, p. 295). In addition to inter-item time, various response forms were also studied. The dependent variable was the number of digits recalled after one presentation. The total-time hypothesis predicted no significant differences among the three conditions of inter-item distribution, however, significant differences were found.

The primary purpose of the Jahnke (1968) study concerned the influence of presentation rate on the serial-position effect. However, information was also presented on total recall. The learning materials were word lists of three lengths (6, 10, and 15) with each length list presented at the rate of $\frac{1}{2}$, 1, 2 or 4 seconds per item. The dependent variable was the number recalled following one presentation. The mean percentage recall for the 6 and 10 words-in-length lists were so large at the $\frac{1}{2}$ second interval as to make appropriate comparisons at longer intervals impossible for a test of the

total-time hypothesis (i.e., in nearly all cases they would have had to have recalls far in excess of 100%). For the 15 words-in-length list appropriate comparisons were possible. Here, both percent recall and mean numbers of items recalled increased with increases in the presentation duration. However, in no cases were the increases sufficient (i.e., the two second condition being twice that of the one second) for the total-time hypothesis to hold.

The Martin (1968) study presented three types of learning material (ordinary sentences, semantically anomalous sentences, and scrambled word strings) with the time interval between words of .5, 1, or 2 seconds. All material was presented behind various masking noise levels. A control condition having no masking noise was not included. Responses were scored for both percentage of words correct and strings (sequences) correct. The results did not fit the expectations of the total-time hypothesis for any of the three types of learning material under either of the two scoring procedures.

Experiment I of Brewer (1967) provided partial support for the total-time hypothesis (Experiment II involved paired associate learning). In this study, the learning material consisted of CVCs of high and low meaningfulness with presentation rates varied over 1, 2 and 4 seconds. Trials were continued to a criterion of one perfect anticipation. The results clearly support the total-time hypothesis for the high meaningful material but did not support the hypothesis for the low meaningful material.

Fisher (1966) used 12 nonsense syllables of intermediate association value with stimulus presentation times varying over 2, 4, 6, 8 and 16 seconds. Following a practice list, subjects were required to learn the material to a criterion of one perfect anticipation. Stimulus presentation time did not effect total learning time thus lending support to the hypothesis.

Combining the above studies with those reviewed by Cooper and Pantle (1967) yields a total of 11 studies. Of these, five gave reasonably clear-cut support for the total-time hypothesis, four did not support the hypothesis

and two supported the hypothesis for learning material of high meaningfulness. The author was unable to detect any consistent differences between supportive and non-supportive studies after examining such obvious variables as time interval involved, learning material, method of testing learning, and criterion used in learning (although this comes close to suggesting that a learning criterion of something other than "recall after one trial" will support the total-time hypothesis).

It should be understood that all of the studies, except that of Martin (1968), used unconnected items as the learning material. Except that Martin used very short passages which were presented under masking, a closer examination of his results for sentences might have provided the present study with specific predictions.

This study will also examine the component processes involved in the learning of connected discourse as a function of inter-item interval. The component analyses will emphasize what has been termed the quantitative and organizational dimensions. These dimensions have been identified in factor analytic studies of retention of connected discourse (e.g., King, 1960; 1968; King & Russell, 1966). Briefly, the general approach has been to obtain sets of recalls of connected discourse, score the recalls for accuracy scores. In approximately 100 such analyses (with matrices ranging from 7 x 7 x 13 x 13) nearly all have resolved to a two factor solution. One factor has its highest loadings on such variables as number or words, number of letters, and number of identical words. This factor has been called a quantitative dimension. The other factor typically has maximal loadings on various sequence scores (sequences of words in the original learning material found in the recall) and idea units. This second factor has been labeled an organizational dimension. Of course, it should be clear that these two component processes do not purport to be an exhaustive analysis of the component processes involved in learning connected discourse.

Method

Learning Material

The learning material consisted of two sets of connected discourse (called List A and List B) for each of the seven lengths examined. The lengths considered were 10, 15, 20, 25, 30, 35 and 40 words-in-length. With two sets at each length, the total sets of learning material consisted of 14 passages which are presented in Appendix A.

Design and Procedure

The basic design of this study was a 2 x 2 x 4 ANOVA. The three dimensions consisted of six by list (A and B) by four inter-item intervals (.5, 1.5, 3.5, and 4.5 seconds). Each of the 16 cells of the above design contained five subjects. This basic 2 x 2 x 4 design was repeated for each of the seven lengths of the learning material, which thus required a total of 560 subjects as no subject was used in more than one treatment condition.

For all 14 sets of learning material, each word was typed on a radio-mat slide in preparation for presentation by a Carousel projector. The exposure interval for each word in all treatment conditions was held constant at .5 seconds by a Wollensack shutter. The four inter-item intervals were controlled by use of two Hunter decade interval timers. The words were projected on the wall of the experimental room.

Subjects were recruited from the pool of introductory psychology students at Oswego. Throughout the duration of this experiment, all students in the college were required to take the first course in psychology. Subjects were assigned to treatment conditions on a random basis (except for sex, numerical, and inter-item interval balance) upon reporting to the laboratory. Subjects were run one at a time with all data gathered in the same experimental room (about 10 by 20 feet). Following a short conversation period to relax the student and ensure his cooperation, the following instructions were given: "The carousel will project a series of words on the wall in front of you.

Your task is to memorize the words in the order presented. Following a presentation, please write down the words on the yellow sheet of paper in a column, one word on a line. We will keep this up until you get it perfect. Are there any questions?" Following the perfect recall, the subject was briefly quizzed regarding his use of rehearsal. Finally, a short explanation of the experiment was provided. Only two subjects were discarded for failure to learn the material within a reasonable number of trails.

The basic learning data were scored in four ways. First, for each subject, the number of trials to criterion was computed. The second and third scoring techniques reflect an assessment of the quantitative and organizational factors described in the previous section. The second measure, for each subject, was the number of words recalled (any word, not necessarily a correct one) on each trial. The third measure, again for each subject, was the number of three-word sequences (identical with the original) recalled on each trial. Finally, each recall of each subject was scored for the number of intrusions.

Results

The results will be presented in three sections. First the results on the number of trials to criteria, followed by the quantitative and organizational factors, and finally, the results for the intrusions.

Trials for Criteria

Appendix B presents the complete data on the number of trials to criterion for each subject. Each table (one for each length of learning material) of Appendix B was submitted to a 2 x 2 x 4 ANOVA. The results of these analyses are presented in Table 1. Clearly, the only variable that indicated any degree of significance with consistency was list differences at the higher lengths. Those interested in specific numerical values for any of the means may easily calculate such from the material presented in Appendix B. For the purpose of this experiment, Figure 1 can best present the relationship between

inter-item interval and number of trials to criterion for each of the lengths. This figure is clearly the main test of the total-time hypothesis and the result is, of course, analogous to line C of the ANOVA summary.

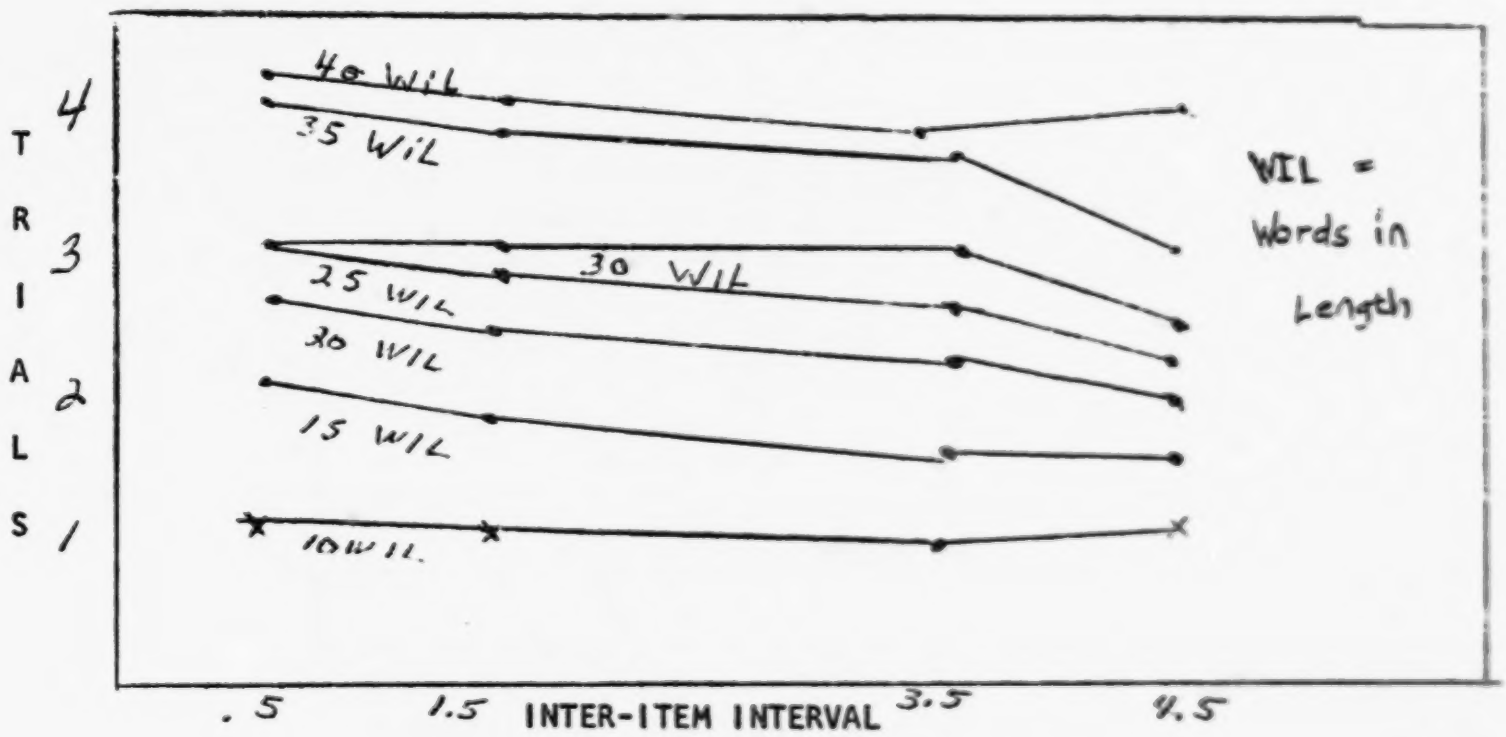
Table 1

Summary of Significance Levels Reached in the Analysis of Number of Trials to Criteria

Dimension	Length of Learning Material						
	10	15	20	25	30	35	40
(A) Sex		.01					.01
(B) List				.001	.001	.001	.001
(C) Inter-item Interval		.01					
A x B							
A x C							
B x C		.05					
A x B x C	.05				.001		

Figure 1

Mean Number of Trials to Criterion as a Function of Inter-item Interval and List Length



Quantitative and Organizational Dimensions

Appendix C presents the complete data on the number of words (quantitative dimension) per subject per trial and the number of three-word sequences (organizational dimension) per subject per trial. Two types of analysis have been done on this data. First, analyses of variance were done on the first learning trial for number of words and number of sequences. The results of these analyses are presented in Tables 2 and 3.

Table 2

Summary of Significance Levels Reached in the Analysis of the Number of Words Recalled on the First Trial

Dimension	Length of Learning Material						
	10	15	20	25	30	35	40
(A) Sex						.01	.05
(B) List		.01	.05	.05		.001	.001
(C) Inter-Item Interval					.001		
A x B							
A x C		.001					
B x C							
A x B x C							

The means were also computed from the data presented in Appendix C for the number of words and the number of sequences recalled for each length on the first recall. The means for the number of words (quantitative dimension) shows a monotonic relationship between itself and the length of the learning material. The relationship between length of the learning material and number of sequences recalled (organizational dimension) exhibited a non-monotonic relationship.

Table 3

Summary of Significance Levels Reached in the Analysis of the Number of Sequences Recalled on the First Trial

Dimension	Length of Learning Material						
	10	15	20	25	30	35	40
(A) Sex		.05		.05		.01	.05
(B) List		.05	.01		.001	.001	.001
(C) Inter-Item Interval		.01	.05			.01	
A x B							
A x C		.01					
B x C							
A x B x C		.05					

In addition to the above analyses, Meltonized learning curve values were also computed for each list (A and B) and for each length of learning material (except for the shortest). The values were calculated for successive fifths of total learning (perfect recall). These values are presented in Appendix D. If the learning curves were plotted for each set of data, the results would show a sharply accelerated (negative) curves with the quantitative dimension (words) being more rapidly learned than the organizational dimension (sequences).

Intrusions

Appendix E presents the number of intrusions per subject on the first trial. Analyses of variance were done on the number of intrusions with the results summarizable as before in Table 4. An analysis was also done on the total number of intrusions (or mean number of intrusions) as a function of the length of the learning material. Table 5 presents the results of this analysis including the ratio of the mean number of intrusions over length (times 100).

Table 4

Summary of Significance Levels Reached in the Analysis of the Number of Intrusions on the First Trial

Dimension	Length of Learning Material						
	10	15	20	25	30	35	40
(A) Sex		.01		.05			
(B) List			.001		.01		
(C) Inter-Item Interval			.05				
A x B							
A x C		.05					
B x C							
A x B x C							

Table 5

First Trial Intrusion Data by Length

Length of Learning Material	Total Number of Intrusions	Mean Number of Intrusions	Mean Intrusions Length (x 100)
10	2	.025	.25
15	28	0.35	2.33
20	54	0.68	3.40
25	119	1.49	5.96
30	85	1.06	3.53
35	114	1.43	4.09
40	125	1.56	3.90

Discussion

The discussion section will consider the results in three sections in the same order as presented in the results section, followed by a general discussion.

Trials to Criteria

Table 1 and Figure 1 have presented the basic results of this study with respect to the total-time hypothesis. For the total-time hypothesis to hold, there must be a marked decrease in the number of trails to criterion as the inter-item interval increases. The failure (except for the 15 words in length material) of the inter-item interval variable to reach significance (line C of Table 1) and the near flat nature of the curves shown in Figure 1 is a reflection of the near total lack of support for the total-time hypothesis. Indeed, one is tempted to consider the "total-trials" hypothesis as an alternative.

The significant list differences (B of Table 1) are very commonplace in the learning of connected discourse and were expected. They were of no importance as the list by inter-item interval interactions (B x C) are nearly devoid of any significant F ratios.

To dramatize the inadequacy of the total-time hypothesis, Table 6 has been prepared showing the total learning time for each length of learning material and inter-item interval. For the total-time hypothesis to hold, the columns should contain approximately the same numbers for each inter-item

Table 6

Mean Total Learning Time

	Length of Learning Material						
Inter-item Interval	10	15	20	25	30	35	40
.5	12.0	31.5	49.0	75.0	90.0	138.3	166.0
1.5	24.0	51.0	88.0	132.5	147.0	252.0	312.0
3.5	46.0	87.0	172.0	240.0	348.0	476.0	576.0
4.5	78.0	112.5	175.0	281.3	367.5	481.3	780.0

value. Clearly, with the learning material consisting of connected discourse,

the total-time hypothesis does not hold.

Quantitative and Organizational Dimensions

Analysis of the first trial retention of words and sequences of words gave results generally similar to that found for trials to criterion. Specifically, the number of words recalled on the first trial (Table 2) showed a very close relationship in terms of pattern of significance to the number of trials to criterion (Table 1). Thus, only list differences were significant in a fairly consistent way over learning length. As mentioned above, such list differences are typical in connected discourse and of little interest for the problem under consideration. The results for the first trial recall for three-word sequences were somewhat more complex. In addition to the expected list differences, four of the seven F tests for sex differences were significant. In all of these four cases (and also in the cases where the F test did not reach statistical significance) females were superior to males. Sex differences are said to be rather common in the learning of unconnected verbal material but far less frequent with connected discourse, (King, 1968). Apparently, at least with this type of presentation of the learning material, female superiority is primarily reflected in greater organizational scores rather than on the quantitative dimension. Three of the seven F-tests for inter-item interval were also significant. In general, the longer the inter-item interval, the greater was the organizational dimension score..

The Meltonized learning curve values (see Appendix D) were not spectacularly successful in separating the quantitative and organization course of learning. While in all cases, the quantitative dimension increased at a more rapid rate than the organizational, the overall learning was so rapid that it was perhaps unreasonable to expect a gross separation.

Intrusions

The results presented in Table 4 show few significant effects and none

consistent over the various lengths of the learning material. The number of intrusions present on the first recall trial seems to increase up to the 25 words-in-length learning material and then remain roughly constant thereafter. The ratio of the mean number of intrusions over length of the learning material seems to reach some sort of plateau with the learning material of twenty words-in-length. From 20 through 40 words-in-length, the above described ratio fluctuates between 3.40 and 5.96 and bears no direct relationship to length.

General Discussion

As stated, the basic purpose of this research was to evaluate the total-time hypothesis for the learning of connected discourse. Within the limits of the time intervals used, the sample of subjects tested, and the specific passages employed, the total-time hypothesis does not hold.

With the rejection of the total-time hypothesis for connected discourse, another question of greater importance is raised. What is the maximally efficient inter-item interval for the learning of connected discourse? It was hoped that it would have been possible to answer this question by an examination of the total learning time data (see Table 6). However, as can be seen from an examination of the data, total learning time continued to decrease as a direct function of decreases in inter-item interval. Still shorter inter-item intervals will need to be tested to determine the most efficient interval.

This research suggests three areas of research where additional work might be of benefit. These three areas will be briefly presented below:

1. Shorter Inter-Item Intervals. - As mentioned above, to find the most efficient inter-item interval, it will be necessary to further decrease the intervals under consideration. The presently used minimal interval of 0.5 seconds is just about at the limit of a Carousel projector. To decrease the interval in any significant way will require the use of several Carousels in series or changing to some form of film projection. With the abondonment of

the total-time hypothesis for connected discourse, the determination of the most efficient interval becomes of paramount importance.

2. Long Term Retention. - All of the work reported here has involved rather short term retention. It is an open question, with regard to the total-time hypothesis, if some longer term retention might or might not give similar results. Future studies should test both short and long-term retention. For most educational purposes, it is the long term retention that is of greater importance.

3. Variable Interval Inter-Item Interval. - All of the work reported here and all other studies of inter-item interval have used a constant inter-item interval. It is proposed that we should also study this problem with variations in the inter-item interval but with the average interval set at some particular value. Two studies seem to have potential. This first would simply utilize the same, or similar, inter-item intervals as the present work (.5, 1.5, etc.). However, these inter-item intervals would be average values over the sentence or sentences with the specific intervals between words showing considerable variation. A second, and more interesting, variation would place the longer inter-item intervals between major linguistic constituents. For example, in the simple sentence "The ball is red", this sentence has, supposedly, two major components (the ball) and (is red) which correspond to the major constituents, noun phrase (NP) and verb phrase (VP), in a phrase structure analysis. Placing a larger inter-item interval at the constituent breaks (with, of course, much more complex sentences) would give greater time for whatever processes (chunking, coding, etc.) might occur. This might be seen as a learning counterpart to the "click perception" studies of Fodor and Bever (1965) and Garret, Bever, and Fodor (1966). It should be noted that nearly all subjects in the present experiment reported engaging in rehearsal between items.

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APPENDIX A

Learning Material

Ten Words in Length

List A: The next question will examine a new area of concern

List B: Are you sure you have understood all of the material

Fifteen Words in Length

List A: The classroom demonstration failed because a fundamental principle of physical science had not been followed

List B: The worried parents sat near the bed where their sick child was nearing the crisis

Twenty Words in Length

List A: A conflict of loyalties was involved. He should protect his brother but doing so would expose his family to danger

List B: He worked on the math problem until late at night. The next morning the solution came to him very easily

Twenty-five Words in Length

List A: The early morning sun shining thru the yellow curtain gave the bedroom a translucent quality. George opened one eye and quickly closed it in disgust

List B: A summer retreat away from the hot city is the goal of many modern families. If all were successful the vactionlands would become summer cities

Thirty Words in Length

List A: The Christmas party was in progress. The central office staff crowded into the reception hall to sing carols. Everyone enjoyed this time of the year with its release from pressure.

List B: One night two young men went down to the river to hunt seals. When they got there it was foggy and calm. Suddenly they heard a noise on the water

Thirty-five Words in Length

List A: He liked to race ice boats. The feel of the cold sharp wind on his face gave him a thrill of adventure. His wife was otherwise inclined and did not join him for the event

List B: The brain of man is a product of a long evolutionary process. It is somewhat odd that surprise is expressed when man sometimes acts like an animal. Evolution does not produce a totally different organism

Forty Words in Length

List A: The normal balance of supply and demand is said to be molded by other than market pressures in the New Industrial State. The freedom of both the consumer and the business manager is limited by the power of the technologists

List B: The midway of the State Fair was crowded with many colorful concessions. The little girl was almost overwhelmed with excitement. It was the first time she has experienced all of the noises smells and sights that go with a fair

APPENDIX B

Number of Trials to Criterion

Ten Words in Length

	List A								List B							
III	.5		1.5		3.5		4.5		.5		1.5		3.5		4.5	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	1	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1
	1	1	2	1	2	1	3	1	1	1	1	1	1	1	1	1
	1	2	1	1	1	1	1	1	2	1	2	1	1	1	2	2
	1	1	1	1	2	1	3	1	1	1	1	2	1	1	1	1
	1	2	1	2	1	1	1	1	1	2	1	1	1	1	2	2

Fifteen Words in Length

	List A								List B							
III	.5		1.5		3.5		4.5		.5		1.5		3.5		4.5	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	3	2	3	1	2	1	3	2	2	1	2	1	1	1	1	2
	1	1	2	1	1	1	2	2	3	2	2	2	2	1	1	1
	2	2	2	1	1	1	3	1	2	2	2	1	2	1	1	1
	2	3	2	1	1	2	1	1	1	2	1	1	2	2	1	1
	2	3	4	2	2	1	2	2	4	2	2	1	2	2	1	1

Twenty Words in Length

	List A								List B							
III	.5		1.5		3.5		4.5		.5		1.5		3.5		4.5	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	2	2	1	2	2	2	1	2	3	2	2	1	2	3	1	1
	2	4	3	1	2	1	2	2	2	2	2	1	2	1	1	2
	5	2	3	2	6	2	1	2	2	3	2	1	2	2	2	2
	3	1	6	2	1	2	2	2	2	2	3	2	4	2	1	1
	4	2	2	3	2	2	3	3	2	2	2	2	2	1	2	2

Twenty-five Words in Length

	List A								List B							
III	.5		1.5		3.5		4.5		.5		1.5		3.5		4.5	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	2	1	2	2	1	2	2	2	5	6	3	4	2	3	3	2
	4	2	2	1	1	2	2	4	4	2	3	4	5	3	2	2
	3	1	5	2	2	2	2	2	4	3	3	3	2	2	3	2
	3	2	2	3	2	2	1	2	3	2	3	2	3	2	2	3
	3	2	2	1	4	2	2	2	5	3	3	3	3	3	2	3

APPENDIX B (cont.)

Thirty Words in Length

	List A								List B							
III	.5		1.5		3.5		4.5		.5		1.5		3.5		4.5	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	4	3	4	3	8	3	3	5	2	2	1	2	3	3	3	1
	6	3	5	3	2	3	3	4	2	3	2	2	1	3	1	2
	3	3	3	4	2	2	3	3	3	1	2	2	2	4	2	2
	5	3	3	2	4	2	2	3	3	2	1	2	2	2	3	2
	3	5	2	2	4	4	3	2	2	2	3	1	2	2	1	1

Thirty-five Words in Length

	List A								List B							
III	.5		1.5		3.5		4.5		.5		1.5		3.5		4.5	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	3	2	2	3	3	2	2	4	3	3	5	4	3	3	5	2
	3	2	4	5	4	2	3	2	4	6	3	4	4	4	2	3
	5	2	3	2	5	2	2	2	5	3	3	7	4	3	3	4
	6	3	5	3	3	5	2	1	10	8	5	2	4	3	4	4
	3	2	3	2	2	2	2	2	3	3	4	3	4	6	3	3

APPENDIX B (cont.)

Forty Words in Length

	List A								List B							
III	.5		1.5		3.5		4.5		.5		1.5		3.5		4.5	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
	4	4	6	5	4	5	2	4	4	5	5	2	2	2	4	2
	5	4	3	3	5	3	8	4	3	4	6	2	5	2	3	5
	3	8	7	4	7	3	4	5	3	2	3	3	3	3	5	3
	4	4	4	3	5	3	6	3	3	2	5	2	3	4	2	3
	6	5	5	4	6	2	3	4	5	5	3	3	2	3	6	2

APPENDIX C

10 Words in Length

List A

Total # of Words

Total # of 3-Word Sequences

	Trials								Trials							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	10								8							
2	10								8							
3	10								8							
4	10								8							
5	10								8							
2 Sec F																
1	8	10							3	8						
2	10								8							
3	10								8							
4	8	10							6	8						
5	10								8							
4 Sec M																
1	10								8							
2	10								8							
3	10	10							5	8						
4	10								8							
5	10								8							
4 Sec F																
1	5	10							2	8						
2	10								8							
3	10								8							
4	10								8							
5	10								8							
8 Sec M																
1	10								8							
2	9	10							5	8						
3	8	10							6	8						
4	10								8							
5	10								8							
8 Sec F																
1	10								8							
2	10								8							
3	10								8							
4	10								8							
5	10								8							
10 Sec M																
1	10								8							
2	8	9	10						5	5	8					
3	10								8							
4	10	10	10						7	7	8					
5	8	10							6	8						
10 Sec F																
1	10								8							
2	10								8							
3	10								8							
4	10								8							
5	10								8							

APPENDIX C (cont.)

10 Words in Length — List B

Total # of Words — Total # of 3-Word Sequences

	Trials								Trials							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	9	10							5	8						
2	10								8							
3	9	10							5	8						
4	10								8							
5	10								8							
2 Sec F																
1	9	10							5	8						
2	10								8							
3	10								8							
4	10								8							
5	10								8							
4 Sec M																
1	10								8							
2	10								8							
3	9	10							5	8						
4	10								8							
5	10								8							
4 Sec F																
1	10								8							
2	10								8							
3	9	10							5	8						
4	10								8							
5	10								8							
8 Sec M																
1	9	10							5	8						
2	10								8							
3	10								8							
4	10								8							
5	10								8							
8 Sec F																
1	10								8							
2	10								8							
3	10								8							
4	10								8							
5	10								8							
10 Sec M																
1	10								8							
2	10								8							
3	8	10							2	8						
4	10								8							
5	10								8							
10 Sec F																
1	10								8							
2	10								8							
3	9	10							5	8						
4	10								8							
5	9	10							5	8						

15 Words in Length

List A

Total # of Words

Total # of 3-Word Sequences

Trials

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	12	15							9	13						
2	15	15							9	13						
3	15								13							
4	15	15							12	13						
5	12	14	15						2	7	13					
2 Sec F																
1	15	14	15						7	10	13					
2	11	15							6	13						
3	14	15							10	13						
4	10	14	15						3	10	13					
5	7	11	15						2	6	13					
4 Sec M																
1	13	14	14	15					1	4	5	13				
2	13	15							5	13						
3	12	15							6	13						
4	15	15							8	13						
5	6	14	15						4	10	13					
4 Sec F																
1	15								13							
2	15								13							
3	15	15							10	13						
4	15								13							
5	15								13							
8 Sec. M																
1	14	15							6	13						
2	15								13							
3	15								13							
4	14	15							9	13						
5	15								13							
8 Sec F																
1	15								13							
2	15								13							
3	15								13							
4	15								13							
5	14	15							10	13						
10 Sec M																
1	13	15							9	13						
2	14	15							3	13						
3	14	18	15						10	10	13					
4	13	14	15						3	10	13					
5	15								13							
10 Sec F																
1	14	15							7	13						
2	15	15							12	13						
3	15								13							
4	15								13							
5	15	15							8	13						

15 Words in Length

List B

Total # of Words

Total # of 3-Word Sequences

Trials

		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																	
	1	14	15	14	15					9	11	11	13				
	2	15								13							
	3	20	15							7	13						
	4	15	14	15						7	11	13					
	5	15	15							10	13						
2 Sec F																	
	1	15	15							11	13						
	2	15								13							
	3	12	15							8	13						
	4	14	15							11	13						
	5	12	15							7	13						
4 Sec M																	
	1	15	15							10	13						
	2	15								13							
	3	14	15							5	13						
	4	15	15							10	13						
	5	12	15							10	13						
4 Sec F																	
	1	15								13							
	2	15								13							
	3	15	15							10	13						
	4	15								13							
	5	15								13							
8 Sec M																	
	1	14	15							10	13						
	2	15								13							
	3	15	15							11	13						
	4	14	15							9	13						
	5	15	15							10	13						
8 Sec F																	
	1	15	15							10	13						
	2	14	15							7	13						
	3	15								13							
	4	15								13							
	5	15								13							
10 Sec M																	
	1	15								13							
	2	15								13							
	3	15								13							
	4	15								13							
	5	15								13							
10 Sec F																	
	1	15								13							
	2	15								13							
	3	15								13							
	4	15								13							
	5	14	15							9	13						

20 Words in Length

List A

Total # of Words

Total # of 3-Word Sequences

Trials

Trials

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	18	20							10	18						
2	18	20							16	18						
3	10	17	19	21	20				0	4	15	15	18			
4	21	20	21	20					15	13	16	18				
5	19	21	20						14	16	18					
2 Sec F																
1	17	21	22	20					4	14	14	18				
2	20								18							
3	20	20							10	18						
4	13	20							7	18						
5	21	20							6	18						
4 Sec M																
1	20	21	20						12	12	18					
2	18	20							16	18						
3	22	21	21	20	20				7	16	16	13	18			
4	4	19	20						2	13	18					
5	20								18							
4 Sec F																
1	20	20							15	18						
2	19	21	20						9	16	18					
3	22	20							14	18						
4	20	20							15	18						
5	20								18							
8 Sec M																
1	20								18							
2	17	20							13	18						
3	20	20							7	18						
4	20	3	17	21	21	20			12	1	8	10	13	18		
5	18	20							16	18						
8 Sec F																
1	19	20							15	18						
2	20								18							
3	21	20							16	18						
4	18	20							14	18						
5	20	20							12	18						
10 Sec M																
1	20								18							
2	18	20							16	18						
3	15	20							11	18						
4	20								18							
5	11	20	20						5	13	18					
10 Sec F																
1	18	20							11	18						
2	18	20							16	18						
3	19	20							11	18						
4	20	20							14	18						
5	20	20							13	18						

20 Words in Length

List B

Total 3 of Words

Total # of 3-Word Sequences

Trials

Trials

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	21	20							13	18						
2	20	20							13	18						
3	17	20							9	18						
4	19	19	20						14	15	18					
5	21	21	20						15	17	18					
2 Sec F																
1	20								18							
2	18	21	20						12	17	18					
3	20	20							14	18						
4	17	20							11	18						
5	19	20							14	18						
4 Sec M																
1	21	20							15	18						
2	20	20	20						15	15	18					
3	21	21	20						15	17	18					
4	21	20							15	18						
5	19	20							15	18						
4 Sec F																
1	20	20							12	18						
2	20								18							
3	20								18							
4	19	20							19	20						
5	20								18							
8 Sec M																
1	18	19	19	20					6	7	11	18				
2	21	20							17	18						
3	19	20							15	18						
4	20	20							11	18						
5	19	20							17	18						
8 Sec F																
1	18	20							15	18						
2	20								18							
3	20	20							13	18						
4	20								18							
5	22	21	20						10	14	18					
10 Sec M																
1	19	20							15	18						
2	22	20							15	18						
3	20								18							
4	20								18							
5	20								18							
10 Sec F																
1	21	20							17	18						
2	21	20							17	18						
3	20								18							
4	20	20							15	18						
5	20								18							

25 Words in Length

List A

Total # of Words

Total # of 3-Word Sequences

Trials

Trials

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	20	24	25						11	13	23					
2	23	25							16	23						
3	23	25	25						8	17	23					
4	17	26	26	25					7	18	21	23				
5	24	24	25						10	17	23					
2 Sec F																
1	25								23							
2	23	25							14	23						
3	25								23							
4	25	25							16	23						
5	25	25							9	23						
4 Sec M																
1	22	25							16	23						
2	22	25							13	23						
3	20	26	26	25	25				3	10	17	18	23			
4	25	25							2	23						
5	25	25							20	23						
4 Sec F																
1	21	25							13	23						
2	24	25	25						11	20	23					
3	25	25							20	23						
4	25								23							
5	25								23							
8 Sec M																
1	25								23							
2	25								23							
3	25	25							14	23						
4	25	25							5	23						
5	25	26	25	25					8	18	20	23				
8 Sec F																
1	25	25							17	23						
2	25	25							11	23						
3	25	25							20	23						
4	23	25							17	23						
5	24	25							13	23						
10 Sec M																
1	25	25							21	23						
2	24	25							17	23						
3	25	25							19	23						
4	25								23							
5	26	25							6	23						
10 Sec F																
1	26	25							21	23						
2	27	27	25	25					6	14	20	23				
3	24	25							16	23						
4	24	25							20	23						
5	24	25							20	23						

25 Words in Length

List B

Total # of Words

Total # of 3-Word Sequences

Trials

	Trials								Trials							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	23	19	20	25					9	14	16	23				
2	27	20	24	24	25				11	16	17	20	23			
3	22	23	25	25					11	17	21	23				
4	18	26	26	25	25				7	18	21	13	23			
5	24	24	25						13	20	23					
2 Sec F																
1	23	25	25	25	24	25			11	20	17	20	20	23		
2	23	24	25						4	19	23					
3	25	25	25						20	20	23					
4	24	25							17	23						
5	22	23	25						14	17	23					
4 Sec M																
1	23	24	25						20	22	23					
2	23	23	25						17	18	23					
3	27	20	25						5	13	23					
4	24	25	25						10	17	23					
5	25	24	25						7	20	23					
4 Sec F																
1	25	24	25						15	20	23					
2	19	23	27	25					13	18	21	23				
3	24	25	25						17	20	23					
4	22	23	24	25					13	17	20	23				
5	26	25							18	23						
8 Sec M																
1	19	24	25						7	13	23					
2	23	25							9	23						
3	24	25							20	23						
4	22	25	25	24					2	20	20	21	23			
5	22	24	25						11	18	23					
8 Sec F																
1	24	25	25						18	20	23					
2	26	25							17	23						
3	22	25							15	23						
4	23	25	25						15	16	23					
5	19	24	25						17	20	23					
10 Sec M																
1	23	25							18	23						
2	26	25							20	23						
3	23	25							18	23						
4	26	26	25						13	21	23					
5	16	26	25						8	16	23					
10 Sec F																
1	23	25							19	23						
2	23	25	25						15	17	23					
3	24	26	25						12	21	23					
4	22	25							8	23						
5	23	25							17	23						

30 Words in Length

List A

Total # of Words

Total # of 3-Word Sequences

Trials

	1	2	3	4	5	6	7	8
2 Sec M								
1	18	30	30	30	30			
2	26	27	30					
3	7	20	31	29	29	30		
4	19	25	30					
5	20	27	29	30				
2 Sec F								
1	16	20	29	29	30			
2	28	29	30					
3	26	30	30					
4	21	29	30					
5	18	32	30					
4 Sec M								
1	17	29	30					
2	30	29	30	30				
3	24	30	29	30	30			
4	29	30	30					
5	29	30						
4 Sec F								
1	26	30	30					
2	25	29	30					
3	30	29	30	30				
4	29	30						
5	28	30						
8 Sec M								
1	36	30	29	29	29	29	30	30
2	29	30						
3	28	30						
4	24	29	29	30				
5	26	26	30	30				
8 Sec F								
1	30	27	30					
2	30	29	30					
3	30	30						
4	29	30						
5	26	29	29	30				
10 Sec M								
1	28	30	30					
2	27	29	30					
3	28	29	30					
4	24	24	30					
5	30	31	30					
10 Sec F								
1	16	30	29	30	30			
2	29	30						
3	27	30						
4	28	29	30					
5	30	29	29	30				

Trials

	1	2	3	4	5	6	7	8
2 Sec M								
1	11	16	18	24	28			
2	11	21	28					
3	2	11	19	25	25	28		
4	6	13	28					
5	8	19	23	28				
2 Sec F								
1	6	10	25	25	28			
2	18	25	28					
3	16	23	28					
4	12	25	28					
5	11	24	28					
4 Sec M								
1	13	25	28					
2	20	25	26	28				
3	10	15	25	25	28			
4	19	25	28					
5	13	28						
4 Sec F								
1	7	24	28					
2	17	25	28					
3	23	23	26	28				
4	22	28						
5	19	28						
8 Sec M								
1	16	20	25	25	25	25	25	28
2	25	28						
3	22	28						
4	13	22	25	28				
5	8	20	22	28				
8 Sec F								
1	15	22	28					
2	18	25	28					
3	23	28						
4	22	28						
5	13	18	25	28				
10 Sec M								
1	18	26	28					
2	23	25	28					
3	14	25	28					
4	17	20	28					
5	20	26	28					
10 Sec F								
1	5	7	21	26	28			
2	25	28						
3	12	28						
4	10	19	28					
5	24	25	25	28				

30 Words in Length

List B

	Total # of Words Trials								Total # of 3-Word Sequences Trials							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	28	30							22	28						
2	29	30							21	28						
3	26	29	30						13	22	28					
4	21	24	30						13	18	28					
5	16	30							8	28						
2 Sec F																
1	18	30							12	28						
2	22	30	30						17	27	28					
3	30								28							
4	28	30							24	28						
5	27	30							21	28						
4 Sec M																
1	28	30							23	28						
2	27	30							25	28						
3	26	30							14	28						
4	30								28							
5	30	28	30						19	24	28					
4 Sec F																
1	30								28							
2	26	30							16	28						
3	24	30							20	28						
4	30	30							25	28						
5	30								28							
8 Sec M																
1	27	30							25	28						
2	27	30							23	28						
3	30								28							
4	22	26	30						16	22	28					
5	23	30							19	28						
8 Sec F																
1	27	27	30						25	25	28					
2	31	31	30						26	26	28					
3	34	31	30	30					19	26	23	28				
4	30	30							27	28						
5	30	30							25	28						
10 Sec M																
1	27	30							25	28						
2	26	29	30						22	25	28					
3	30								28							
4	30								28							
5	29	26	30						24	22	28					
10 Sec F																
1	30								28							
2	27	30							25	28						
3	26	30							22	28						
4	28	30							24	28						
5	30								28							

35 Words in Length

List A

Total # of Words

Total # of 3-Word Sequences

Trials

	1	2	3	4	5	6	7	8
2 Sec M								
1	30	32	35					
2	30	32	35					
3	30	33	33	35	35			
4	26	34	35					
5	25	32	35	35	37	35		
2 Sec F								
1	26	35						
2	33	35						
3	35	35						
4	27	35						
5	28	32	35					
4 Sec M								
1	32	34	35					
2	29	35						
3	31	35	35	35				
4	29	37	35					
5	30	30	31	35	35			
4 Sec F								
1	30	35						
2	33	33	33					
3	37	38	30	33	35			
4	38	35						
5	27	35	35					
8 Sec M								
1	36	35	35	35				
2	28	35						
3	25	33	35					
4	30	33	36	35	35			
5	27	34	35					
8 Sec F								
1	32	35						
2	34	35						
3	30	33	35	36	35			
4	32	35						
5	35	35						
10 Sec M								
1	32	35						
2	32	35						
3	34	35						
4	29	35						
5	27	35	35					
10 Sec F								
1	35	35						
2	34	35						
3	24	35						
4	34	32	34	35				
5	35							

Trials

	1	2	3	4	5	6	7	8
2 Sec M								
1	11	25	33					
2	22	25	33					
3	16	25	29	30	33			
4	11	29	33					
5	13	19	20	27	27	33		
2 Sec F								
1	15	33						
2	28	33						
3	30	33						
4	21	33						
5	14	25	33					
4 Sec M								
1	21	29	33					
2	25	33						
3	24	30	30	33				
4	24	31	33					
5	16	24	24	30	33			
4 Sec F								
1	11	33						
2	22	24	33					
3	17	29	22	27	33			
4	26	33						
5	21	30	33					
8 Sec M								
1	21	27	30	33				
2	23	33						
3	7	26	33					
4	15	19	30	30	33			
5	14	28	33					
8 Sec F								
1	27	33						
2	23	33						
3	16	29	21	31	33			
4	28	33						
5	30	33						
10 Sec M								
1	23	33						
2	15	33						
3	25	33						
4	25	33						
5	16	29	33					
10 Sec F								
1	30	33						
2	23	33						
3	20	33						
4	27	21	30	33				
5	33							

35 Words in Length

List B

Total # of Words

Total # of 3-Word Sequences

Trials

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	27	28	35						11	17	33					
2	28	30	35	35					16	23	27	33				
3	21	34	35						8	30	33					
4	20	29	30	32	35				6	11	18	28	33			
5	12	18	20	24	26	32	36	36	0	6	7	17	16	26	27	27
2 Sec F						36 (9)		35 (10)						31 (9)		33 (10)
1	18	30	31	34	35	35			6	14	24	30	28	33		
2	29	34	35						12	20	33					
3	32	33	35						4	19	33					
4	29	32	33	33	33	35	35	35	9	24	24	29	27	27	30	33
5	26	32	35						15	21	33					
4 Sec M																
1	23	33	35	35	35				8	20	25	29	33			
2	18	32	34	35	35				12	17	30	29	33			
3	22	31	35						12	21	33					
4	17	30	34	35					5	23	30	33				
5	27	35	35						17	30	33					
4 Sec F																
1	27	25	34	35					7	13	30	33				
2	14	27	31	35					7	17	24	33				
3	30	35							15	33						
4	22	36	35						11	19	33					
5	26	34	34	35	35	33	35		8	25	23	30	30	21	33	
8 Sec M																
1	22	27	30	35					7	15	21	33				
2	15	34	33	35					6	26	26	33				
3	25	33	35						12	25	33					
4	22	28	34	35					12	21	30	33				
5	30	33	34	35					19	27	30	33				
8 Sec F																
1	31	35	35						16	26	33					
2	30	36	35	35	35	35			14	23	30	30	30	33		
3	18	34	35						14	27	33					
4	35	35	35						21	27	33					
5	18	22	33	35					4	10	23	33				
10 Sec M																
1	21	35							12	33						
2	20	34	26	33	35				5	14	22	24	33			
3	30	35	35						22	28	33					
4	21	31	34	35					8	21	30	33				
5	30	34	35						14	30	33					
10 Sec F																
1	30	27	35						16	30	33					
2	31	33	34	35					17	25	30	33				
3	28	34	35						23	30	33					
4	33	34							20	33						
5	22	35	34	35					15	22	27	33				

40 Words in Length

List A

	Total # of Words								Total # of 3-Word Sequences							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	10	12	20	21	31	40			0	1	7	17	24	38		
2	10	30	37	40					8	19	34	38				
3	33	38	40						10	32	38					
4	16	40	38	40	40				9	24	31	35	38			
5	39	37	39	40					10	21	32	38				
2 Sec F																
1	20	30	39	39	40				6	21	21	34	38			
2	21	30	37	40					10	15	22	38				
3	19	17	26	32	36	40	40	40	10	7	15	17	26	35	26	38
4	21	31	35	40					18	16	26	38				
5	24	33	40	40					15	21	35	38				
4 Sec M																
1	24	31	40	40	40				17	25	33	35	38			
2	25	38	40						10	29	38					
3	26	34	40	39	39	40	40		19	24	32	20	35	33	38	
4	31	42	39	40					19	34	36	38				
5	15	30	40	41	41	40			5	13	27	30	23	38		
4 Sec F																
1	29	38	40						14	32	38					
2	22	35	40	40					10	27	35	38				
3	30	35	39	40					8	24	35	38				
4	25	37	40						9	30	38					
5	21	35	40	41	40				17	25	35	33	38			
8 Sec M																
1	24	35	40	39	40				6	27	34	35	38			
2	22	31	36	39	41	41	40		8	16	28	25	36	36	38	
3	19	21	32	40					4	10	18	38				
4	21	31	39	36	40				6	17	35	30	38			
5	25	31	35	40	40	40			9	16	21	29	35	38		
8 Sec F																
1	31	40							15	38						
2	34	39	40						24	35	38					
3	21	38	40						11	31	38					
4	37	40	40						22	35	38					
5	29	34	39	40	40				16	30	32	35	38			
10 Sec M																
1	31	40	35	39	40	40			22	33	25	33	35	38		
2	17	18	40	40					7	11	32	38				
3	28	11	27	35	33	23	43	40	10	7	7	19	18	18	35	38
4	34	40							18	38						
5	12	31	40						5	24	38					
10 Sec F																
1	28	38	41	40					8	29	33	38				
2	16	33	36	40					6	27	29	38				
3	32	39	41	40					19	28	30	38				
4	27	37	40						11	29	38					
5	30	36	40	40	40				15	27	35	35	38			

40 Words in Length

List B

Total # of Words

Total # of 3-Word Sequences

Trials

	1	2	3	4	5	6	7	8
2 Sec M								
1	15	35	39	39	40			
2	30	35	40					
3	39	40	40					
4	39	39	40					
5	31	36	40	40				
2 Sec F								
1	19	40						
2	34	37	38	38	40			
3	36	40						
4	37	37	41	40				
5	31	40	36	41	40			
4 Sec M								
1	28	38	39	41	40			
2	26	35	39	39	39	40		
3	35	39	40					
4	34	36	39	38	40			
5	33	39	40					
4 Sec. F								
1	39	40						
2	40	39	40					
3	30	40						
4	42	40						
5	39	36	40					
8 Sec M								
1	38	40						
2	40	40						
3	28	38	40					
4	23	28	40					
5	21	33	39	39	40			
8 Sec F								
1	37	40	40					
2	39	39	38	40				
3	35	38	40					
4	33	40						
5	39	40						
10 Sec M								
1	35	40						
2	25	38	42	38	40			
3	36	40	41	40				
4	28	40	40					
5	36	40	37	39	39	40		
10 Sec F								
1	38	40						
2	34	36	40					
3	39	37	40					
4	35	39	39	39	40			
5	36	40						

	1	2	3	4	5	6	7	8
	8	19	27	35	38			
	15	26	38					
	24	33	38					
	26	35	38					
	17	27	38	38				
	6	38						
	21	25	27	33	38			
	23	38						
	15	20	36	38				
	20	29	27	36	38			
	16	30	35	36	38			
	11	25	35	32	35	38		
	23	31	38					
	10	20	29	34	38			
	20	36	38					
	30	38						
	24	35	38					
	15	38						
	26	38						
	25	30	38					
	34	38						
	35	38						
	16	34	38					
	16	26	38					
	6	17	26	35	38			
	29	33	38					
	35	32	33	38				
	21	33	38					
	21	38						
	22	38						
	26	38						
	16	28	36	34	38			
	19	29	36	38				
	9	34	38					
	27	35	31	35	35	38		
	23	38						
	13	28	38					
	35	30	38					
	21	31	32	35	38			
	26	38						

Appendix D

Meltonized Values for the Learning of Successive Fifths of Total Criterion for both Words and Sequences

15 Words in Length Material

List A			List B		
Criteria	Words	Sequences	Criteria	Words	Sequences
100	1.7	1.8	100	1.3	1.6
80	1.1	1.6	80	1.0	1.2
60	1.0	1.3	60	1.0	1.0
40	1.0	1.2	40	1.0	1.0
20	1.0	1.0	20	1.0	1.0

20 Words in Length Material

List A			List B		
Criteria	Words	Sequences	Criteria	Words	Sequences
100	1.5	2.3	100	1.4	1.9
80	1.1	1.7	80	1.0	1.3
60	1.0	1.2	60	1.0	1.1
40	1.0	1.1	40	1.0	1.0
20	1.0	1.0	20	1.0	1.0

25 Words in Length Material

List A			List B		
Criteria	Words	Sequences	Criteria	Words	Sequences
100	1.5 ,	2.1	100	2.2	3.0
80	1.0	1.8	80	1.1	2.0
60	1.0	1.3	60	1.0	1.4
40	1.0	1.1	40	1.0	1.1
20	1.0	1.0	20	1.0	1.0

30 Words in Length Material

List A			List B		
Criteria	Words	Sequences	Criteria	Words	Sequences
100	2.4	3.4	100	1.8	2.0
80	1.3	2.2	80	1.1	1.4
60	1.1	1.6	60	1.0	1.1
40	1.0	1.3	40	1.0	1.0
20	1.0	1.0	20	1.0	1.0

35 Words in Length Material

List A			List B		
Criteria	Words	Sequences	Criteria	Words	Sequences
100	2.3	2.9	100	3.3	4.0
80	1.2	2.0	80	1.8	2.9
60	1.0	1.4	60	1.2	2.2
40	1.0	1.1	40	1.0	1.7
20	1.0	1.0	20	1.0	1.1

40 Words in Length Material

List A			List B		
Criteria	Words	Sequences	Criteria	Words	Sequences
100	3.6	4.4	100	2.8	3.3
80	2.4	3.2	80	1.3	2.3
60	1.6	2.6	60	1.1	1.6
40	1.1	1.8	40	1.0	1.2
20	1.0	1.2	20	1.0	1.0

Appendix E

10 Words in Length

Number of Intrusions

		List A								List B							
		Trials								Trials							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																	
	1	0								0	0						
	2	0								0							
	3	0								0	0						
	4	0								0							
	5	0								0							
2 Sec F																	
	1	0	0							0	0						
	2	0								0							
	3	0								0							
	4	0	0							0							
	5	0								0							
4 Sec M																	
	1	0								0							
	2	0								0							
	3	0								0	0						
	4	0								0							
	5	0								0							
4 Sec F																	
	1	1	0							0							
	2	0								0							
	3	0								0	0						
	4	0								0							
	5	0								0							
8 Sec M																	
	1	0								0	0						
	2	0	0							0							
	3	0	0							0							
	4	0								0							
	5	0								0							
8 Sec F																	
	1	0								0							
	2	0								0							
	3	0								0							
	4	0								0							
	5	0								0							
10 Sec M																	
	1	0								0							
	2	0	0	0						0							
	3	0								0	0						
	4	1	1	0						0							
	5	0								0							
10 Sec F																	
	1	0								0							
	2	0								0							
	3	0								0	0						
	4	0								0							
	5	0								0	0						

15 Words in Length

Number of Intrusions

		List A								List B							
		Trials								Trials							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																	
	1	0	0							2	1	1	0				
	2	1	0							0							
	3	0								4	0						
	4	1	0							2	0	0					
	5	2	0	0						0							
2 Sec F																	
	1	0	0	0						1							
	2	0	0							0							
	3	0	0							0	0						
	4	0	0	0						0	0						
	5	0	1	0						0	0						
4 Sec M																	
	1	1	1	1	0					1	0						
	2	0	0							0							
	3	0	0							3	0						
	4	0	0							1	0						
	5	0	0	0						0	0						
4 Sec F																	
	1	0								0							
	2	0								0							
	3	1	0							0	0						
	4	0								0							
	5	0								0							
8 Sec M																	
	1	0	0							0	0						
	2	0								0							
	3	0								1	0						
	4	1	0							1	0						
	5	0								1	0						
8 Sec F																	
	1	0								0	0						
	2	0								1	0						
	3	0								0							
	4	0								0							
	5	0								0							
10 Sec M																	
	1	0	0							0							
	2	1	0							0							
	3	0	1	0						0							
	4	0	0	0						0							
	5	0								0							
10 Sec F																	
	1	0								0							
	2	1	0							0							
	3	0								0							
	4	0								0							
	5	0								1	0						

20 Words in Length

Number of Intrusions

		List A								List B							
		Trials								Trials							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																	
	1	1	0							1	0						
	2	0	0							1	0						
	3	2	2	1	1	0				1	0						
	4	1	1	1	0					1	0	0					
	5	1	1	0						0	0	0					
2 Sec F																	
	1	4	1	1	0					0							
	2	0								0	0	0					
	3	3	0							0	0						
	4	1	0							0	0						
	5	5	0							1	0						
4 Sec M																	
	1	2	2	0						1	0						
	2	0	0							1	1	0					
	3	4	0	0	1	0				0	0	0					
	4	0	1	0						0	0						
	5	0								0	0						
4 Sec F																	
	1	0								2	0						
	2	2	1	0						0							
	3	2	0							0							
	4	1	0							0	0						
	5	0								0							
8 Sec M																	
	1	0								1	0	0	0				
	2	0	0							0	0						
	3	1	0							0	0						
	4	1	0	0	3	1	0			0	0						
	5	0	0							0	0						
8 Sec F																	
	1	0	0							0	0						
	2	0								0							
	3	1	0							1	0						
	4	0	0							0							
	5	1	0							2	0	0					
10 Sec M																	
	1	0								0	0						
	2	0	0							0	0						
	3	0	0							0							
	4	0								0							
	5	0	2	0						0							
10 Sec F																	
	1	2	0							0	0						
	2	0	0							0	0						
	3	2	0							0							
	4	2	0							0	0						
	5	2	0							0							

25 Words in Length

Number of Intrusions

		List A								List B							
		Trials								Trials							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																	
	1	2	1	0						2	0	0	0				
	2	0	0							3	0	1	0	0			
	3	4	2	0						3	0	0	0				
	4	2	2	1	0					3	2	1	2	0			
	5	2	1	0						4	0	0					
2 Sec F																	
	1	0								1	0	0	0	0	0		
	2	1	0							5	1	0					
	3	0								1	0	0					
	4	2	0							1	0						
	5	5	0							1	0	0					
4 Sec M																	
	1	0	0							0	0	0					
	2	1	0							2	0	0					
	3	2	2	0	0	0				9	0	0					
	4	3	0							3	1	0					
	5	1	0							2	0	0					
4 Sec F																	
	1	1	0							0	0	0					
	2	3	1	0						0	1	2	0				
	3	1	0							0	0	0					
	4	0								0	0	0	0				
	5	0								1	0						
8 Sec M																	
	1	0								1	0	0					
	2	0								0	0						
	3	2	0							0	0						
	4	4	0							3	0	0	0	0			
	5	5	1	1	0					1	0	0					
8 Sec F																	
	1	2	0							0	0	0					
	2	1	0							1	0						
	3	1	0							0	0						
	4	0	0							0	0	0					
	5	2	0							0	0	0					
10 Sec M																	
	1	1	0							0	0						
	2	1	0							2	0						
	3	1	0							0	0						
	4	0								4	0	0					
	5	4	0							0	3	0					
10 Sec F																	
	1	1	0							0	0						
	2	2	1	1	0					1	1	0					
	3	2	0							4	0	0					
	4	0	0							1	0						
	5	0	0							1	0						

30 Words in Length

Number of Intrusions

	List A								List B							
	Trials								Trials							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																
1	2	3	4	2	0				0	0						
2	2	0	0						0	0						
3	0	1	1	0	0	0			3	1	0					
4	2	1	0						0	0	0					
5	2	1	1	0					0	0						
2 Sec F																
1	2	2	0	0	0				1	0						
2	2	0	0						0	0	0					
3	2	0	0						0							
4	0	0	0						1	0						
5	0	2	0						0	0						
4 Sec M																
1	0	0	0						0	0						
2	2	0	0	0					0	0						
3	2	3	0	1	0				3	0						
4	1	1	0						0							
5	4	0							3	0	0					
4 Sec F																
1	3	2	0						0							
2	2	0	0						4	0						
3	1	0	0	0					0	0						
4	1	0							1	0						
5	0	0							0							
8 Sec M																
1	4	1	0	1	0	0	1	0	0	0						
2	0	0							0	0						
3	1	0							0							
4	1	1	0	0					0	0	0					
5	2	0	1	0					0	0						
8 Sec F																
1	4	0	0						0	0	0					
2	1	0	0						1	1	0					
3	0	0							4	1	1	0				
4	1	0							0	0						
5	3	2	0	0					1	0						
10 Sec M																
1	1	0	0						0	0						
2	0	0	0						0	0	0					
3	4	0	0						0							
4	0	0	0						0							
5	2	0	0						0	0	0					
10 Sec F																
1	1	6	1	0	0				0							
2	0	0							0	0						
3	0	0							0	0						
4	5	1	0						1	0						
5	2	0	0	0					0							

35 Words in Length

Number of Intrusions

		List A								List B									
		Trials								Trials									
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9	10
2 Sec	M																		
	1	1	0	0						5	0	0							
	2	3	1	0						1	1	2	0						
	3	1	0	0	1	0				1	0	0							
	4	1	1	0						2	2	1	0	0					
	5	1	2	2	2	0	0			0	0	2	1	4	0	3	1	1	0
2 Sec	F																		
	1	0	0							0	3	0	0	0	0				
	2	2	0							0	3	0							
	3	2	0							7	5	0							
	4	0	0							1	0	0	0	0	0	0			
	5	1	1	0						1	0	0							
4 Sec	M																		
	1	1	0	0						1	3	2	1	0					
	2	0	0							0	2	0	0	0					
	3	2	1	1	0					0	2	0							
	4	0	0	0						0	2	0	0						
	5	3	1	1	1	0				1	1	0							
4 Sec	F																		
	1	3	0							1	0	0	0						
	2	2	2	0						0	3	1	0						
	3	2	1	0	0	0				2	0								
	4	3	0							2	1	0							
	5	1	0	0						3	3	1	1	1	0	0			
6 Sec	M																		
	1	2	2	1	0					2	2	2	0						
	2	0	0							1	1	1	0						
	3	0	0	0						2	1	0							
	4	1	0	0	0	0				2	0	0	0						
	5	0	0	0						1	0	0	0						
6 Sec	F																		
	1	1	0							2	0	0							
	2	3	0							2	2	1	1	1	0				
	3	1	0	0	1	0				1	1	0							
	4	1	0							1	0	0							
	5	4	0							3	2	0	0						
10 Sec	M																		
	1	2	1							1	0								
	2	0	0							4	4	1	1	0					
	3	0	0							1	0	0							
	4	1	0							1	0	0	0						
	5	4	2	0						0	0	0							
10 Sec	F																		
	1	1	0							0	1	0							
	2	3	0							0	0	0	0						
	3	0	0							1	0	0							
	4	1	0	0	0					0	0								
	5	0								1	0	1	0						

40 Words in Length

Number of Intrusions

		List A								List B							
		Trials								Trials							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
2 Sec M																	
	1	2	1	2	0	0	0			1	3	2	0	0			
	2	0	0	0	0					0	0	0					
	3	4	0	0						2	1	0					
	4	1	5	0	1	0				2	0	0					
	5	7	4	1	0					2	1	0	0				
2 Sec F																	
	1	1	0	0	0	0				1	0						
	2	0	2	1	0					3	1	2	0	0			
	3	0	0	0	2	0	0	0	0	2	0						
	4	0	2	0	0					9	3	0	0				
	5	1	2	0	0					1	1	1	1	0			
4 Sec M																	
	1	1	0	0	1	0				2	2	0	0	0			
	2	0	0	0						1	0	0	1	0	0		
	3	0	0	0	0	0	0	0		1	0	0					
	4	1	1	0	0					4	1	1	0	0			
	5	0	2	1	0	0	0			2	0	0					
4 Sec F																	
	1	0	0	0						0	0						
	2	2	0	0	0					0	0	0					
	3	2	1	0	0					2	0						
	4	0	0	0						3	0						
	5	0	1	1	0	0				2	0	0					
8 Sec M																	
	1	0	0	0	0	0				0	0						
	2	3	0	0	0	0	0	0		1	0						
	3	4	0	2	0					2	0	0					
	4	2	1	0	0	0				2	0	0					
	5	3	3	1	1	0	0			3	3	3	0	0			
8 Sec F																	
	1	0	0							0	0	0					
	2	1	0	0						0	0	0	0				
	3	0	0	0						3	0	0					
	4	1	0	0						3	0						
	5	3	0	0	0	0				1	0						
12 Sec M																	
	1	2	0	0	0	0	0			0	0						
	2	1	0	2	0					1	0	1	0	0			
	3	2	0	4	2	1	1	0	0	1	2	1	1				
	4	4	0							4	1	1					
	5	0	0	1						1	1	1	0	1	0		
12 Sec F																	
	1	1	0	1	0					1	1						
	2	1	1	0	1					4	1	1					
	3	1	0	1	1					1	1	1					
	4	4	1	1						2	1	1	1	1			
	5	2	0	0	1	1				1	1						